



Standard Test Method for Water and Sediment in Middle Distillate Fuels by Centrifuge¹

This standard is issued under the fixed designation D 2709; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reappraisal. A superscript epsilon (ε) indicates an editorial change since the last revision or reappraisal.

This standard has been approved for use by agencies of the Department of Defense.

^{ε1} NOTE—Paragraph 1.1 was corrected editorially in March 1998.

^{ε2} NOTE—Paragraph 6.2 was corrected editorially in August 1999.

1. Scope

1.1 This test method covers the determination of the volume of free water and sediment in middle distillate fuels having viscosities at 40°C (104°F) in the range of 1.0 to 4.1 mm²/s (1.0 to 4.1 cSt) and densities in the range of 770 to 900 kg/m³.

NOTE 1—Fuels corresponding to Specification D 975 Grades 1D and 2D, Specification D 2880 Grades 0-GT, 1-GT and 2-GT, and Specification D 3699 Grades 1-K and 2-K will usually fall in this viscosity and density range. Test Method D 1796 is intended for higher viscosity fuel oils.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parenthesis are for information only.

1.3 *This standard does not purport to address all safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the application of regulatory limitations prior to use.*

2. Referenced Documents

- 2.1 *ASTM Standards:*
 - D 396 Specification for Fuel Oils²
 - D 975 Specification for Diesel Fuel Oils²
 - D 1796 Test Method for Water and Sediment in Fuel Oils by the Centrifuge Method (Laboratory Procedure)²
 - D 2880 Specification for Gas Turbine Fuel Oils³
 - D 3699 Specification for Kerosine³
 - D 4057 Practice for Manual Sampling of Petroleum and Petroleum Products³

3. Terminology

3.1 *Description of Terms Specific to This Standard:*

3.1.1 *distillate fuel*—a virgin or cracked or blend of virgin and cracked distillate having a flash point greater than 38°C.

¹ This test method is under the jurisdiction of ASTM Committee D-2 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.14 on Stability and Cleanliness of Liquid Fuels.

Current edition approved January 10, 1996. Published March 1996. Originally published as D 2709 – 68. Last previous edition D 2709 – 93.

² *Annual Book of ASTM Standards*, Vol 05.01.

³ *Annual Book of ASTM Standards*, Vol 05.02.

4. Summary of Test Method

4.1 A 100-mL sample of the undiluted fuel is centrifuged at a relative centrifugal force of 800 for 10 min. at 21 to 32°C (70 to 90°F) in a centrifuge tube readable to 0.005 mL and measurable to 0.01 mL. After centrifugation, the volume of water and sediment which has settled into the tip of the centrifuge tube is read to the nearest 0.005 mL and reported as the volumetric percent water and sediment by centrifuge.

5. Significance and Use

5.1 This test method is used as an indication of water and sediment in middle distillate fuels such as Grades Nos. 1 and 2 fuel oil, (Specification D 396) Nos. 1-D and 2-D diesel fuel, (Specification D 975) and Nos. 0-GT, 1-GT, and 2-GT gas turbine fuels (Specification D 2880).

5.2 Appreciable amounts of water and sediment in a fuel oil tend to cause fouling of the fuel-handling facilities and to give trouble in the fuel system of a burner or engine. An accumulation of sediment in storage tanks and on filter screens can obstruct the flow of oil from the tank to the combustor. Water in middle distillate fuels can cause corrosion of tanks and equipment, and if detergent is present, the water can cause emulsions or a hazy appearance. Water is necessary to support microbiological growth at fuel water-interfaces in fuel systems.

6. Apparatus

6.1 *Centrifuge*, capable of whirling two or more filled centrifuge tubes at a speed which can be controlled to give a relative centrifugal force (rcf) of 800 ± 60 at the tip of the tubes. The revolving head, trunnion rings, and trunnion cups, including the cushions, are to be soundly constructed to withstand the maximum centrifugal force capable of being delivered by the power source. The trunnion cups and cushions shall support the tubes when the centrifuge is in motion. The centrifuge shall be enclosed by a metal shield or case strong enough to eliminate danger if any breakage occurs.

6.2 The data in Table 1 can be used to determine the centrifuge speed setting required for the centrifuge to meet relative centrifugal force requirements for this method and was developed using the following equations: